

RESEARCH REPORT

Associations of smoking prevalence with individual and area level social cohesion

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Study objective: To discover if area level social cohesion, neighbourhood safety, and home safety are associated with current cigarette smoking among adults after adjustment for concentrations of poverty and low education.

Design: Cross sectional survey of a random sample of adults, stratified by 19 geographical areas.

Setting: SHAPE, Survey of the Health of Adults, the Population, and the Environment—conducted in 1998 by the Hennepin County Community Health Department and the Minneapolis Department of Health and Family Support in Minnesota.

Participants: 5256 men and 4806 women, 18 years and older, randomly selected from 19 geographical areas in an urban county.

Main results: Overall, 21.2% of survey respondents reported current cigarette smoking. Both higher area level social cohesion (OR = 0.85, 95% CI = 0.74 to 0.98) and higher individual social cohesion (OR = 0.96, 95% CI = 0.92 to 0.99) were associated with lower likelihoods of smoking. Similar models were obtained for neighbourhood safety and home safety.

Conclusions: These findings contribute to the growing literature on the important role of social cohesion and other area level characteristics on smoking behaviour among adults.

Although the overall rate of smoking tobacco has declined among adults in the USA, disparities in its use continue. Family income, education, and age are inversely related to smoking.^{1–3} Men are more likely to smoke than women, although this gap is narrowing. American Indians/Alaskan Natives, blue collar workers, and military personnel have the highest rates of smoking in adults.² In addition, individual risk factors such as being a homosexual^{4–5} and personal distress^{6–8} have been associated with smoking.

More recent studies have focused on area level characteristics as predictors of smoking. Neighbourhood deprivation (for example, unemployment, overcrowded households, crime, concentrations of low education) is a set of ecological variables that has been positively associated with smoking.^{9–11} Few studies, however, have emphasised positive area level characteristics that may have negative associations with (that is, protect residents from) smoking. Social cohesion, defined as “the extent of connectedness and solidarity among groups in society,”¹² may serve such a protective function. In addition to an individual’s personal sense of connectedness to his/her community, the aggregated perceptions of members of a geographical community provide an area level indicator of social cohesion; at this area level, it can be viewed as a component of social capital.^{13–14} The construct of social capital has been conceptualised in multiple ways and generally refers to features of social organisation, such as mutual trust and reciprocity within a community, and/or the extent and intensity of associational links or activities of community members.^{12–15–17} Social capital, as well as community level social cohesion, are properties of a neighbourhood, community, or geographical area; they are ecological.

Social capital has reported positive associations with self rated health status^{13–14} and negative associations with firearm related violent crime¹⁸ and youth delinquency and crime.¹⁹ It has been hypothesised that social capital may influence the health behaviours of residents in at least three ways: by promoting more rapid diffusion of health information,²⁰ by increasing the likelihood that norms of healthy behaviour are

adopted, and by exerting social control over deviant health related behaviour.^{21–22}

Social cohesion, both from the perspective of the individual and from the collective perspective of community members living in a defined area, may serve protective functions relative to health status and health related behaviour in much the same way that social capital is protective. In this paper, we explore the hypothesis that both a personal sense of social cohesion and residence in a geographical area with a collective sense of social cohesion are negatively associated with smoking among adults.

METHODS

Sample

The study sample was derived from a population based survey—SHAPE, Survey of the Health of Adults, the Population, and the Environment—conducted in 1998 by the Hennepin County Community Health Department and the Minneapolis Department of Health and Family Support in Minnesota, USA.²³ Residents of Hennepin County, the largest urban county in Minnesota (with 793 622 adults 18 years and older based on the 1990 census), were selected at random through a two stage sampling process. In stage one, an up to date telephone list (including listed and unlisted numbers) was used to randomly select households in Hennepin County. In stage two, one adult, 18 years or older, was randomly selected from each household for a telephone interview. Among 11 921 households contacted, 10 745 interviews were completed (90.1% response rate). The final study sample was 10 617 because 128 cases were excluded because of missing information on household size, age, or gender, which are required for weighting. Detailed description of the study population, sampling design, and weighting scheme have been published elsewhere.²³

The survey sample was stratified by 19 geographical areas in Hennepin County. Among them, 11 were communities in the city of Minneapolis and eight were suburban or rural Hennepin County communities. Each geographical area

included about 550 respondents. Survey weights were constructed to account for differences in household size, in the size of the population in the 19 geographical areas, and in response rates between men and women and people of different ages. The final number of respondents in the dataset is 10 062, which excludes people for whom measured covariates or analysis variables were incomplete. The 10 062 respondents represent 84.4% of contacted households or 94.8% of the final study sample.

Individual level measures

The overall survey design was based on a conceptual model developed by Wolfson²⁴ for assessing health outcomes, resources, and decisions. The measures included in the analyses in this paper are based on the following questions and scales.

Smoking

Current smoking was based on the answer “smoke now” in response to a single item: “How would you describe your cigarette smoking habits?” Thus our primary outcome variable is dichotomous and coded as “smoke now” (yes/no).

Social cohesion

The community support subscale from the social support index²⁵ was used to assess an individual’s personal sense of social cohesion. Six Likert scaled items focus on the respondent’s degree of agreement with the following items: (1) People can depend on each other in this community; (2) Living in this community gives me a secure feeling; (3) People here know they can get help from the community if they are in trouble; (4) This is not a very good community to bring children up in; (5) There is a feeling in this community that people should not get too friendly with each other; (6) If I had an emergency, even people I do not know in this community would be willing to help. Items 4 and 5 are reverse scored. The range of possible scores is from 6 to 24, with higher scores indicating greater social cohesion. The published internal consistency reliability for this scale (Cronbach’s α)²⁵ is 0.82 and was 0.80 for this study sample. This scale provided a measure of an individual’s sense of interpersonal trust and reciprocity in his/her community.

Neighbourhood safety and home safety

A single yes/no item was used to assess an individual’s sense of safety—first, in the home and second, in the neighbourhood (“During the past year, have you restricted your activities because you did not feel safe (1) in your home? (2) in your neighbourhood?”). The direction of the scale was reversed so that each variable was coded 1 for those who did not restrict their activities and 0 for those who did.

Demographic characteristics

Standard demographic questions with categorical response choices were used to assess gender, age, education, income (as a percentage of the 1996 Federal Poverty Level—FPL), race, and health insurance. See table 1 for the categorical groupings of age, education, income, and race; these groupings were chosen by the SHAPE design team to provide comparisons with other surveys. Reported income was missing for 18.6% of the respondents and hence was imputed using multiple regression with expectation maximisation estimation.²³

Area level measures

Social cohesion

An ecological or area level variable was created for each of the 19 geographical areas by calculating the statistical mean of all the respondents’ social cohesion scores (described above) within each area. This approach to assessing area level

social cohesion is consistent with the work of other investigators who have aggregated individual reports within a geographical area to generate a compositional area level social cohesion score,¹⁹ which Kawachi and his colleagues have called social capital.^{13 14 18}

Neighbourhood safety and home safety

Two area level variables were created for each of the 19 geographical areas by calculating the statistical mean of all the respondents’ neighbourhood safety responses and of their home safety responses within each area. As the direction of the individual level variables was reversed, these area level variables represent the percentage of respondents who did not restrict their activities because of feeling unsafe. We will refer to these variables as “feel safe at home” and “feel safe in neighbourhood.”

Concentrations of poverty and low education

Two area level categorical variables were created for poverty and low education. A geographical area had a “high concentration of poverty” if $\geq 20\%$ of its residents reported income at 150% or less of the 1996 FPL. Medium concentration of poverty was defined as 10%–19% of the residents reporting income at 150% or less of the FPL, and low concentration of poverty was defined as $< 10\%$ of residents reporting income at 150% or less of the FPL. These cut off points provided an adequate distribution of geographical areas across levels of this variable.

A geographical area had a “high concentration of low education” if $\geq 4.7\%$ (mean+1 SD) of its residents reported less than a high school education. Medium concentration of low education was defined as 4.4%–4.6% of residents reporting less than a high school education, and low concentration of low education was defined as $< 4.4\%$ (mean–1 SD) of residents reporting less than a high school education. These cut off points provided an adequate distribution of geographical areas across levels of this variable.

Statistical methods

Descriptive statistics for the observed frequency of smoking were computed for various participant characteristics. Logistic regressions were carried out to explore the associations of individual level characteristics, area level characteristics, and their interactions with the probability of smoking using SUDAAN version 8.0 (Research Triangle Institute, Research Triangle Park, NC, USA). We fit a population averaged (marginal) version of a multilevel (hierarchical) logistic model for binary outcomes with within-cluster (Hennepin County area) correlation. Regression parameters were estimated with generalised estimating equations^{26 27} using an independence working correlation with robust (sandwich) variance estimates and tested with approximate Wald F tests. The high multicollinearity of area level social cohesion, area level home safety, and area level neighbourhood safety precluded using these three variables in the same logistic regression model; separate logistic regressions were carried out using each of these ecological variables. All two way interactions between individual level and area level variables were included in initial models and then dropped if non-significant at level 0.05. Predicted smoking probabilities were computed for all participants from the final model and summarised within selected demographic groups. All analyses took the probability based sampling weights and the clustering (by geographical area) design into account and thus represent the target adult population in Hennepin County, Minnesota. Reported p values are not adjusted for multiple comparisons.

RESULTS

In table 1, individual characteristics of the study population, the range of each characteristic across the 19 geographical

Table 1 Individual level characteristics

Characteristic	Overall† number (%)	Range across 19 geographical areas		Overall number (%) who smoke
		Lowest (%)	Highest (%)	
Overall smoking	10062 (100)	16.1	32.7	2136 (21.2)
Gender				
Female	5256 (52.2)	45.8	55.1	996 (18.9)
Male	4806 (47.8)	44.9	54.2	1139 (23.7)
Age (y)				
18–24	1364 (13.7)	9.2	51.7	509 (37.3)
25–34	2108 (20.9)	14.6	32.6	406 (19.3)
35–44	2860 (28.4)	12.7	42.2	672 (23.5)
45–54	1495 (14.9)	4.4	18.5	300 (20.1)
55–64	828 (8.2)	4.2	10.8	133 (16.1)
65+	1408 (14.0)	4.9	20.8	115 (8.2)
Education				
< High school	441 (4.4)	2.3	12.7	143 (32.4)
High school	2137 (21.2)	11.6	34.7	645 (30.2)
Some college	3389 (33.7)	26.9	41.8	860 (25.4)
Bachelor	2832 (28.1)	17.1	34.8	367 (13.0)
Graduate+	1263 (12.6)	4.6	25.3	121 (9.6)
Family income (% 1996 FPL)				
≤ 100	976 (9.7)	6.4	27.8	242 (24.8)
101–150	359 (3.6)	0.7	11.8	107 (29.8)
151–200	597 (5.9)	2.1	10.5	132 (22.1)
201–300	1449 (14.4)	10.9	20.8	346 (23.9)
301–400	2015 (20.0)	10.4	27.2	443 (22.0)
401–500	1145 (11.4)	5.2	16.2	229 (20.0)
501–600	883 (8.8)	4.4	11.8	196 (22.2)
601+	2639 (26.2)	10.9	37.0	440 (16.7)
Race				
White	9137 (90.8)	52.2	99.2	1917 (21.0)
Black	376 (3.7)	0.0	33.1	91 (24.2)
Other‡	550 (5.5)	0.7	15.9	127 (23.1)
Health insurance				
Yes	9204 (91.5)	82.2	95.1	1838 (20.0)
No	858 (8.5)	4.9	17.8	298 (34.7)
Feel safe in neighbourhood				
Yes	8654 (86.0)	56.9	97.3	1786 (20.6)
No	1409 (14.0)	2.7	43.1	350 (24.8)
Feel safe at home				
Yes	9685 (96.3)	88.2	99.1	2028 (20.9)
No	377 (3.7)	0.9	12.0	108 (28.6)
Social cohesion mean	17.99 (SD = 2.58)	15.4	19.21	$r = -0.120^*$

* $p < 0.001$. †Weighted sample size. The total weighted sample size for different characteristics varies by a few cases due to the rounding of the summation of the weight used for the data analysis. ‡“Other” races included Asian/Pacific Islander, American Indian/Alaska Native, and Multi-racial/Other.

areas, and the percentage who smoked for each category of a characteristic are presented. Overall, 21.2% of the sample smoked. Generally, the trends in smoking across individual demographic characteristics were consistent with previous reports.^{1,2} For example, fewer women smoked than men, smoking declined as education increased, and smoking declined with age (except 25–34 year olds smoked less than those 35–54 years). Although the number without health insurance was small (8.5%), they were more likely to smoke (34.7%) than those with insurance (20%). More respondents indicated that they did not feel safe in their neighbourhoods (14.0%) compared with not feeling safe at home (3.7%). However, those who felt unsafe at home were more likely to smoke (28.6%) than the other three groups: those who felt unsafe in their neighbourhood (24.8%), those who felt safe at home (20.9%), and those who felt safe in their neighbourhood (20.6%). Individual level social cohesion was negatively correlated with smoking ($r = -0.12$, $p < 0.001$).

There was a wide range across the 19 geographical areas for several of the individual characteristics. The overall percentage of smokers ranged from a low of 16.1% in one geographical area to twice that (32.7%) in another. Other large characteristic ranges were found in the percentage of participants not feeling safe in their neighbourhoods (2.7% to 43.1%) and not feeling safe at home (0.9% to 12.0%). The proportion of people from racial and ethnic minorities varied

across areas from 0.8% to 47.8%. There was greater income variability across areas at the lowest income levels. Education differences across areas were greatest at the extremes—that is, among those with the most and the least amounts of education. Table 2 shows the descriptive statistics for the area level characteristics. Reflecting our methods for defining group boundaries, nearly a third of the areas (31.6%) had high concentrations of poverty and 42.1% had high concentrations of less than high school education. Predictably, concentration of poverty and low education were significantly correlated ($r = 0.60$, $p < 0.01$).

Rates of smoking followed the expected gradient with higher smoking rates in the most ecologically deprived areas. Point biserial correlations between smoking and the other three area level characteristics (continuous measures) were all negative and significant ($p < 0.001$): area level social cohesion ($r = -0.81$), neighbourhood safety ($r = -0.82$), and home safety ($r = -0.87$).

The unadjusted, partially adjusted, and fully adjusted results of three logistic regression models using, respectively, (1) social cohesion, (2) neighbourhood safety, and (3) home safety are presented in table 3. In Model 1, the presence of area level social cohesion alone (unadjusted for other characteristics) decreased the likelihood of smoking by 21% for each one point increase in the area level social cohesion score (OR = 0.79, 95% CI = 0.74 to 0.85). It remained negatively associated with

Table 2 Area level characteristics

Characteristic (categorical measures)	Number (%) of areas (total = 19)	% Who smoke	
Concentration of poverty (% \leq 150% FPL)			
Low	6 (31.6)		18.6
Medium	7 (36.8)		22.3
High	6 (31.6)		26.9
Concentration of < HS education			
Low	9 (47.4)		19.0
Medium	2 (10.5)		21.5
High	8 (42.1)		25.6
Characteristic (continuous measures)	Mean (SD) (n = 19)	Median (n = 19)	Correlation with smoking
Social cohesion	17.64 (1.17)	17.74	$r = -0.811^*$
Neighbourhood safety	81.86 (12.2)	83.39	$r = -0.822^*$
Home safety	94.58 (3.84)	96.09	$r = -0.871^*$

* $p < 0.001$.

smoking in both the partially adjusted model (OR = 0.84, 95% CI–0.78 to 0.91) and the fully adjusted model (OR = 0.85, 95% CI–0.74 to 0.98). Individual level social cohesion showed an additional negative association with smoking over and above living in a neighbourhood with high area level social cohesion. For each one point increase in the individual social cohesion score, there was a 4% decreased likelihood of smoking (OR = 0.96, 95% CI–0.92 to 0.99).

In model 2, using neighbourhood safety measures, area level, but not individual level, neighbourhood safety was negatively associated with smoking. In the fully adjusted model, 1% higher area level neighbourhood safety was associated with a reduced odds of smoking of 1% (OR = 0.99, 95% CI–0.98 to 1.00). Thus, an area with 98% feeling safe in their neighbourhood (mean+1 SD) compared with an area with 91% feeling safe (mean–1 SD) had a 28% lower smoking rate. In addition, each one point increase in individual level social cohesion reduced the risk of smoking by 22% (OR = 0.78, 95% CI–0.65 to 0.95).

In model 3, using home safety measures, area level, but not individual level, home safety was negatively associated with smoking. One per cent higher area level home safety was associated with a reduced odds of smoking of 4% (OR = 0.96, 95% CI–0.93 to 1.00). Here again in this safety model, a one point increase in individual level social cohesion reduced the risk of smoking by 4% (OR = 0.96, 95% CI–0.93 to 0.99).

In figure 1, we graph the model 1 results to show the way in which both individual social cohesion and area level social cohesion are associated with lower smoking rates under

different combinations of individual level characteristics. The predicted probabilities are computed from model 1 using each quartile cut off point for the observed social cohesion scores. The pattern is similar when family income is <200% of FPL and the level of education is high school (fig 1A) compared with when family income >400% FPL and the level of education is a bachelor's degree (fig 1B). However, the overall probability of smoking is greater under circumstances of greater deprivation. In addition, the impact of area level social cohesion on smoking is larger than the impact of individual social cohesion on smoking. The decrease in smoking across area level social cohesion for a fixed individual social cohesion level is greater than the decrease across individual social cohesion for a fixed area level social cohesion. This also can be seen in table 3: the odds ratio for a one point increase in area level social cohesion is 0.85, while the odds ratio for a one point increase in individual social cohesion is 0.96.

DISCUSSION

The findings from these analyses add additional support to the literature on the associations of area characteristics with smoking by showing that area level social cohesion and safety measures have important associations with smoking. Each has a significant association with smoking above and beyond their corresponding individual level measures, with area level social cohesion showing the strongest association. These effects hold even after adjusting for area level social deprivation measures (low education levels and high poverty levels) and standard individual level demographic

Table 3 Odds ratios for smoking by individual and area level characteristics

	Odds ratio (95% CI)		
	Unadjusted	Partially adjusted*	Fully adjusted†
Model 1: Social cohesion			
Individual level social cohesion‡	–	0.96 (0.93 to 0.99)	0.96 (0.92 to 0.99)
Area level social cohesion	0.79 (0.74 to 0.85)	0.84 (0.78 to 0.91)	0.85 (0.74 to 0.98)
Model 2: Feel safe in neighbourhood			
Individual level social cohesion‡	–	0.96 (0.93 to 0.99)	0.78 (0.65 to 0.95)
Individual level neighbourhood safety	–	0.94 (0.75 to 1.17)	0.93 (0.75 to 1.15)
Area level neighbourhood safety	0.98 (0.97 to 0.98)	0.98 (0.98 to 0.99)	0.99 (0.98 to 1.00)
Model 3: Feel safe at home			
Individual level social cohesion‡	–	0.96 (0.93 to 0.99)	0.96 (0.93 to 0.99)
Individual level home safety	–	0.89 (0.64 to 1.23)	0.86 (0.63 to 1.16)
Area level home safety	0.93 (0.91 to 0.95)	0.95 (0.93 to 0.97)	0.96 (0.93 to 1.00)

*Adjusted for individual characteristics (gender, age, race, education, family income, health insurance) and individual level social cohesion, neighbourhood safety, and home safety. †Adjusted for all individual level characteristics and area level characteristics (concentration of poverty, concentration of < HS education).

‡Individual level social cohesion was a significant predictor in all models; individual level home safety and neighbourhood safety were not significant predictors in model 1 and were dropped.

Key points

- Area level social cohesion, which is akin to the concept of social capital, is an ecological factor associated with a lower likelihood of smoking.
- Individual risk behaviours, like smoking, need to be understood in a social context, wherein social, cultural, and economic constraints and resources shape individual choices.

Policy implications

Public policies and programmes that contribute to the development of socially cohesive neighbourhoods may have a synergistic effect enhancing the impact of public health messages about risk behaviours and healthy lifestyle behaviours.

characteristics. Thus, area level factors are not only sources of increased risk, as previous studies have shown,^{9–11} but they also can have protective associations, as area level social cohesion does. Our measure of area level social cohesion is not just the absence of neighbourhood poverty and educational deprivation, as it showed a significant association with smoking after adjustment for those factors.

From the perspective of other studies that have shown a relation between social capital and self perceived health,^{13–14} our findings provide evidence that area level social cohesion also may be associated with a specific health behaviour, such as smoking. The exact mechanism by which area level social cohesion and smoking affect each other cannot be determined from our data. As suggested by others,^{20–22} area level social cohesion may involve sharing information—in this case, about the consequences of smoking—and discouraging the use of tobacco, both of which could help establish a social norm against smoking.

Another potential mechanism through which social cohesion may have an effect is by strengthening psychological resources—mutual respect, self esteem, optimism, and hopefulness.¹² These psychological resources would, in turn, reduce distress, a known risk factor for smoking. This interpretation would be consistent with the high correlation we found between area level social cohesion and area level neighbourhood safety and home safety as feeling unsafe at home or in your neighbourhood, or both, could be viewed as proxy measures of distress.

These findings point to the importance of considering smoking as an individual behaviour that not only occurs in, but also is shaped by, a social context. Smoking is one of four

behaviours (along with drinking, diet, and exercise) implicated in the aetiology of many of the major chronic diseases contributing to morbidity and mortality in the present era.²⁸ In the past, these behaviours have been viewed as a matter of individual free choice with the concomitant search for individual characteristics that increase the risk for unhealthy behaviours. Hence, most interventions and health education programmes have been designed to change the person. However, a newer perspective in public health is that individual behaviour needs to be understood in a broader social context, wherein social, cultural, and economic constraints and resources shape individual choices.^{29–30} Individual choices, in turn, shape and maintain social conditions, and this recursive process more accurately accounts for behaviours such as smoking.³¹ As with any systemic, recursive process, the notion of causation becomes moot. Interventions could be targeted at any point in the circular sequence of effects.

A limitation of this study is that we used secondary data and hence did not begin with an a priori definition of what is a meaningful geographical area for considering its relation to smoking. Rather, the geographical unit we used was limited to the 19 areas defined for sampling purposes in this study. No other smaller geographical unit was specified in the data collected. The size of the geographical area used in our analyses may have been so large that it masked some of the variation within geographical areas, which may have led to reduced estimates of associations. Although all study participants resided within the same county, they lived in several different municipalities. Eleven of the areas were within one urban city; the other eight were in differing municipalities. These local units of government have varying policies and some of these could affect smoking behaviour, such as ordinances banning where cigarettes are sold.

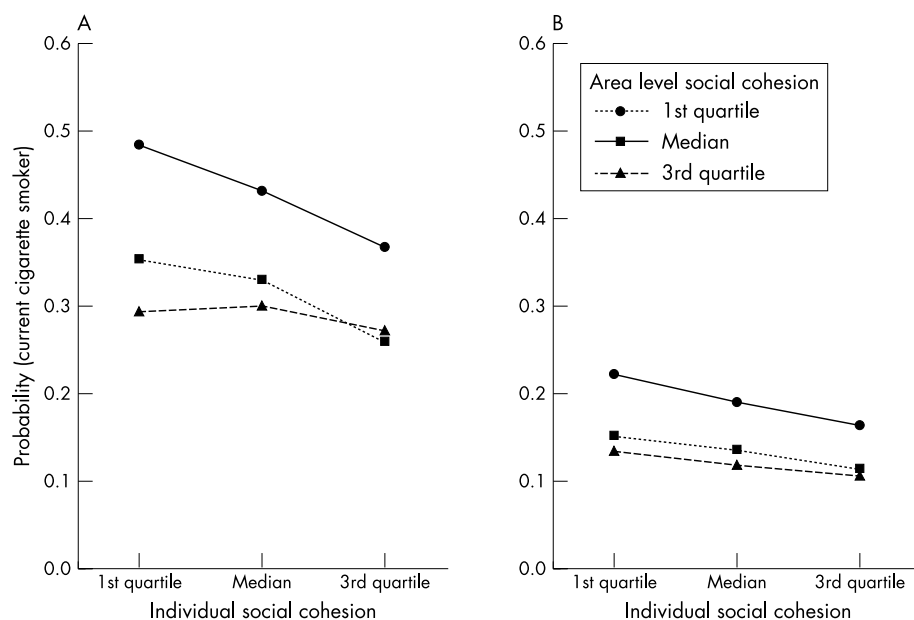


Figure 1 Relation between individual social cohesion and area level social cohesion.

Another limitation of using secondary data is our inability to investigate other factors that may have mediated the association between social cohesion and smoking. At a minimum, our findings have generated a new hypothesis related to the protective role of community level social cohesion, which could be tested in a study designed specifically for that purpose.

The cross sectional nature of this study precludes any inferences of prediction or causation. We may only speak of associations, and we consider our analyses to be exploratory in nature rather than hypothesis confirming.

We have suggested that our measure of area level social cohesion is similar to certain aspects of the social capital construct. While our measure approximates the cognitive or relational component of social capital as it has been defined by others,^{12 15–17 29} we did not have a measure of the structural aspects of social capital. In addition, we created the area level social cohesion variable as an aggregation within a geographical area of individual responses to the same scale we used to measure individual social cohesion. This compositional measure is in contrast with a true contextual assessment of social capital, which would not rely on individual reports. We are not aware, however, of any studies of a health behaviour like smoking where an integral, contextual measure has been used, although several authors have encouraged such an approach.^{15–17 29 30}

Conclusions

One way to test theories about multilevel effects on health behaviour would be through intervention studies where the relevant variables are manipulated. Interventions to increase individual social cohesion have been demonstrated in many arenas, with varying results.²¹ Is it possible to promote social cohesion at the community or ecological level as a way to improve health behaviours and outcomes? At a global level, there is considerable interest in promoting the development of social cohesion and social capital as a mechanism for reducing poverty and promoting economic development.³² In both the United Kingdom³³ and Australia,³⁴ government supported efforts are underway to promote social capital as a strategy to improve health. Furthermore, community based participatory research and health promotion, which emphasise empowerment, capacity building, and the development of natural helping networks, may strengthen community level social cohesion even when that is not the primary intention of such efforts.³⁵ With the growing evidence of the importance of social cohesion and social capital as protective factors associated with health, strategies for promoting its development seem warranted.

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